

**INSTRUCTION AND OPERATING MANUAL**

MODEL 200D

AUDIO OSCILLATOR

Serial 70,000 and Above



**HEWLETT-PACKARD COMPANY**

395 Page Mill Road • Palo Alto, California, U.S.A.



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FOR

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395 PAGE MILL ROAD, PALO ALTO, CALIFORNIA, U.S.A.





# INSTRUCTIONS

## MODEL 200D

## AUDIO OSCILLATOR

### Specifications

#### Frequency Rating --

Frequency Range - 7 to 7000 cycles/sec.

Frequency Dial Calibration - 7 to 70

Range -

x1	7 to 70 cycles/sec.
x10	70 to 700 cycles/sec.
x100	700 to 7000 cycles/sec.
x1000	7000 to 70,000 cycles/sec.

Calibration Accuracy -  $\pm 2\%$

Frequency Response -  $\pm 1$  db - 7 to 70,000 cycles/sec. Reference:  
10 volts at 1000 cycles/sec. into 1000 ohms load.

Frequency Stability -  $\pm 2\%$  under the normal temperature conditions  
including initial warm-up drift.  $\pm 10\%$  line voltage variations will  
change the frequency less than  $\pm .2\%$  at 1000 cycles/sec.

#### Power Output Rating --

Power Output - 100 milliwatts into rated load. (10 volts into a 1000  
ohms load).

Distortion - Less than 1% of rated output, 10 to 70,000 cycles/sec.

Hum voltage - Less than .1% of rated output.

Load Impedance - 1000 ohms, resistive

Internal Impedance - Approximately 25 ohms, 50 to 70,000 cycles/sec.

One side of output grounded.

#### Power Supply Rating --

Voltage - 105 to 125 volts

Frequency - 50/60 cycles

Wattage - 80 watts

#### Overall Dimensions --

Rack Model - 19" wide x 8-3/4" high x 12-1/4" deep

Panel - 19" x 8-3/4", Depth behind panel - 10-1/2"

Cabinet Model - 18-3/4" wide x 8-3/4" high x 12" deep

## Weight --

Cabinet Model - 25 pounds

Rack Model - 27 pounds

## Operating Instructions

### Inspection --

This instrument has been thoroughly tested and inspected before being shipped and is ready for use when received.

After the instrument is unpacked, the instrument should be carefully inspected for damage received in transit. If any shipping damage is found, follow the procedure outlined in the "Claim for Damage in Shipment" page at the back of this instruction book.

### Controls and Terminals --

AC Power - This toggle switch, which is located in the lower left corner of the control panel, controls the power supplied to the instrument from the power line. When the switch is in the ON position, the red indicator will glow.

FUSE - The fuseholder, located on the back of the chassis, contains a one ampere cartridge fuse. The fuse may be replaced by unscrewing the fuseholder cap and inserting a new fuse.

RANGE - This rotary switch inserts various range resistors in the frequency determining circuit of the oscillator. The position of this switch indicates the multiplying factor for the frequency dial calibration and which frequency dial scale should be used.

Frequency Dial - The frequency dial is calibrated directly in cycles per second for the lowest frequency range.

AMPL. - This variable resistor controls the amplitude of the oscillator voltage admitted to the amplifier and therefore the output voltage of the instrument.

Power Cable - The power cable consists of three conductors. Two of these conductors carry power to the instrument while the third conductor (green wire) is connected to the instrument chassis. The third wire projects from the cable near the plug end of the cable and may be connected to a ground when it is desirable to have a grounded instrument chassis.

Output Terminals - The two binding posts, in the lower right corner of the control panel, are the output terminals. The lower binding post is connected to the chassis.



## Operation --

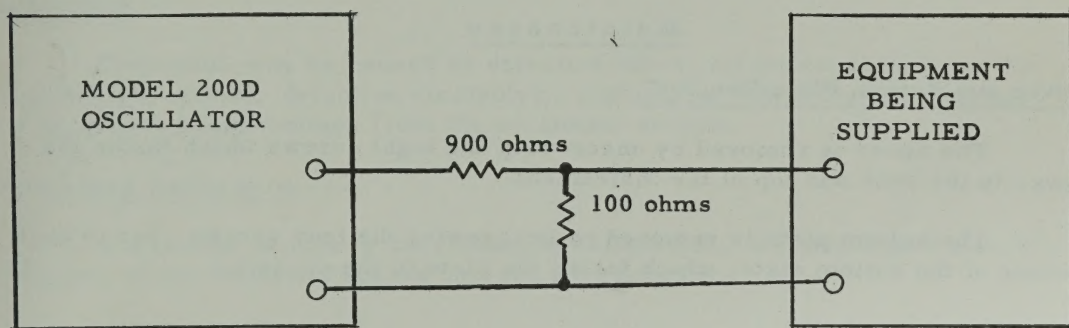
Plug the power cable of the Model 200D into a 115 volts, 50/60 cycles power source and turn on the AC power switch. The instrument will begin to operate as soon as the tubes have heated, but for maximum accuracy a warm-up period of about 30 minutes is necessary.

Set the frequency dial and RANGE switch so that their indications, when multiplied together, equal the desired frequency. For example, if it is desired to select an output frequency of 1000 cycles per second, set the frequency dial to 10 and the RANGE switch to  $\times 10$ .

Connect the output of the oscillator to the equipment being driven and adjust the AMPL. control for the desired output voltage.

Although the rated load for the Model 200D is 1000 ohms, higher or lower impedance loads may be used without damage to the instrument. A higher impedance load will result in less power output and a lower impedance load will increase the percentage of distortion in the output voltage.

As the output voltage of the audio oscillator is reduced, the percentage of hum voltage will increase. At the lower levels this hum voltage becomes quite large, relative to the sine wave output voltage. This undesirable condition can be remedied by operating the audio oscillator at or slightly below rated output and inserting a suitable attenuator between the oscillator and the equipment being driven by the oscillator. The voltage divider circuit shown next is satisfactory for most applications.



Other values of resistance may be used to obtain different voltage divisions. In all cases, the sum of the divider resistors should match the rated load of 1000 ohms.

## Circuit Description

The Model 200D Audio Oscillator consists of an oscillator section, an amplifier section, and a conventional power supply.

The oscillator section (tubes V1 and V2) is a resistance-tuned type circuit. Basically, this oscillator is a two-stage resistance-coupled amplifier which is caused to oscillate by the use of a positive feedback network. This network is a frequency-selective resistance-capacity combination which controls the frequency of oscillation. By using a variable tuning condenser for the capacity of the network, it is possible to tune the oscillator over a wide 10:1 range; and by using a switching arrangement to select different values of resistance for the network, several ranges are given to the oscillator.

Negative feedback is used in the oscillator section in order to minimize distortion and to obtain a very high order of stability. The amount of negative feedback is determined by a resistance network, one element of which is non-linear (the 6-watt lamp in the cathode of V1). This element controls the amount of feedback in accordance with the amplitude of oscillation and consequently maintains the amplitude of oscillation substantially constant over a wide frequency range. The negative feedback also keeps the operation of the system on the linear portion of the tube characteristics. It is notable that the lamp has sufficient thermal inertia so that it operates well even at low frequencies.

Following the oscillator is the output amplifier section which includes tubes V3 and V4. Negative feedback is used in the amplifier in order to minimize distortion and to provide a good frequency response.

## Maintenance

### Cover and Bottom Plate Removal --

The cover is removed by unscrewing the eight screws which fasten the cover to the back and top of the instrument.

The bottom plate is removed by unscrewing the four screws, one in each corner of the bottom plate, which fasten the plate to the chassis.

### Tube Replacement --

When replacing any of the tubes except the power rectifier, it is desirable to measure the distortion in the output if maximum performance from the instrument is desired, because a poor tube can cause excessive distortion without seemingly affecting the operation. The distortion should be less than 1% of the rated output with rated load from 10 to 70,000 cycles. Distortion may also be caused by leaking coupling capacitors and open by-pass capacitors.



### Replacement of Lamp R9 --

The 6-watt lamp R9 is operated at a very low level and should have an almost infinite life. Therefore, the lamp should not be changed indiscriminately. However, should the lamp require changing, it is necessary to check the ac voltage from the junction of R21 and C9 to ground with the new lamp in the circuit. As measured with a high-impedance ac vacuum tube voltmeter, this voltage should be within the range of approximately 18-22 volts when the Model 200D is tuned to 1000 cps. If the voltage is not within this range, it may be corrected by adjusting R13.

If the voltage cannot be brought within the range from 18 to 22 volts by means of R13, the new lamp should be rejected in favor of another.

### Intermittent Output --

"Jumpy" or intermittent output accompanied by flashing of the 6 watt oscillator lamp (R9) is a reliable indication of a short in trimmer capacitor C2 (mounted on gear drive) or in the four front (nearest the panel) sections of the main tuning capacitor. If these symptoms occur, search out and clear the short with a weak air jet or other means. Do not bend the capacitor plates because bending capacitor plates will destroy the frequency calibration.

A short in the four rear sections of the main tuning capacitor or in trimmer C4 (mounted on chassis at rear end of tuning capacitor) will prevent the circuit from oscillating. Any such short should be cleared as explained above.

### Distortion --

Distortion may be caused by defective tubes, electrical leakage in the coupling capacitors, defective electrolytic capacitors, low DC supply voltage, or excessive output voltage from the oscillator section.

### Frequency Calibration --

If a change occurs in the frequency calibration, the instrument should be returned to the Hewlett-Packard Co. for re-calibration.

## Trouble Shooting --

The following is a listing of possible symptoms, causes and remedies.

<u>Symptoms</u>	<u>Causes</u>	<u>Remedies</u>
Instrument inoperative (Indicator light won't light, no audio output)	Blown fuse	Clear short circuit and replace fuse.
Instrument inoperative (Indicator lamp lights, no audio output)	Defective tube Check 5Y3GT tube.	Replace tube (See "Tube Replacement" in Main- tenance section).
	Short circuit in DC power circuit capacitor	Replace capacitor
	Short circuit in C3 (four rear sections) or C4	Clear the short circuit as outlined in the "Intermit- tent Output" paragraph in the Maintenance section.
Intermittent Output	Short circuit in C3 (four front sections) or C2	Clear the short circuit as outlined in the "Intermit- tent Output" paragraph in the Maintenance section.
	Capacitor C6, C9, C10 or C11 intermittently open	Replace capacitor
Excessive Distortion	Defective tube	Replace tube (See "Tube Replacement" in Main- tenance section).
	Open capacitor C11, C14abcd or C15	Replace capacitor
	Leaking capacitor C6, C9, C10, C11, or C12	Replace capacitor

## INSTRUCTIONS FOR RECTIFIER TUBE REPLACEMENT

These instructions apply to any Hewlett-Packard instrument in which a 5V4 tube is mounted in the power rectifier tube socket. When it is necessary to replace the rectifier tube, a 5Y3GT tube may be used as a replacement if the following instructions are followed.

### INSTRUMENTS WITH DC VOLTAGE REGULATOR CIRCUIT -

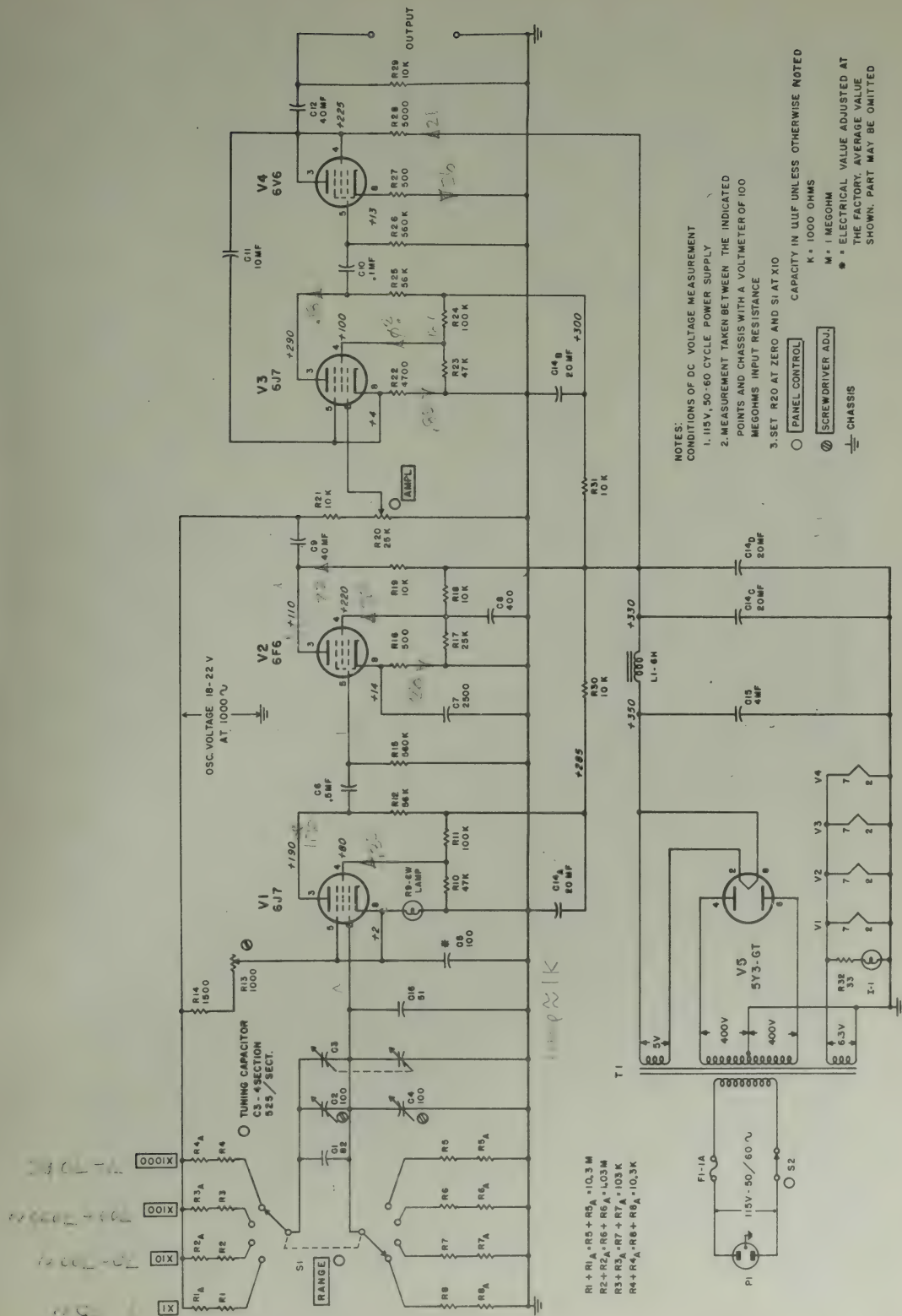
The 5V4 tube may be replaced by a 5Y3GT tube without any circuit changes. After the 5Y3GT tube has been installed, the regulated voltage should be measured to see if it agrees with the voltage shown on the schematic wiring diagram in the instruction book. If the regulated voltage is incorrect, it may be corrected by following the instructions in the instruction book.

### INSTRUMENTS WITHOUT DC VOLTAGE REGULATOR CIRCUIT -

The 5V4 tube may be replaced by a 5Y3GT tube providing the resistor, in series with the DC output of the rectifier, is removed. This resistor does not appear in the schematic wiring diagram in the instruction book. The following instruments use a 500 ohms series resistor: Models 200C, 200D, 202D, 210A, 300BCD, and the 400A.



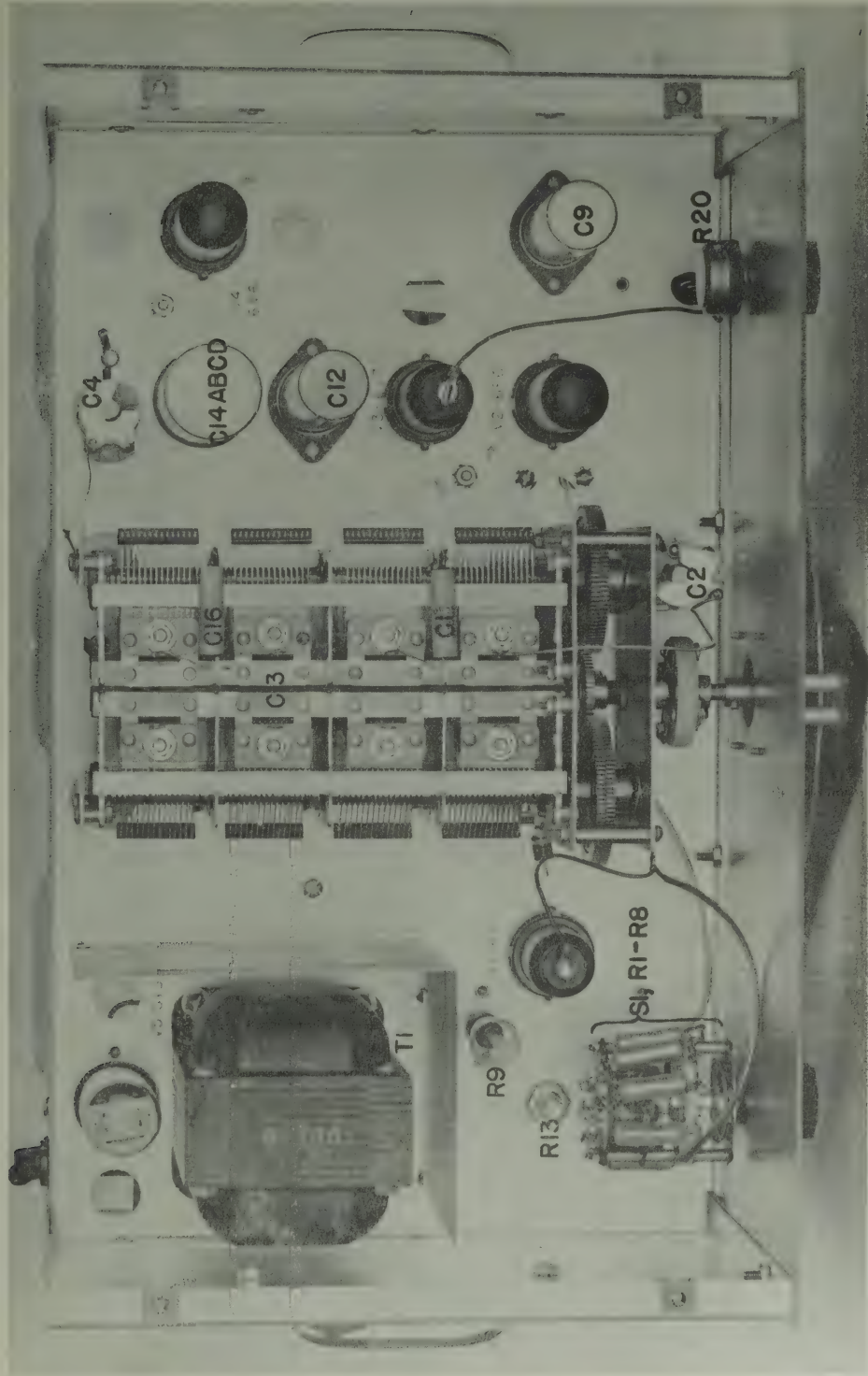




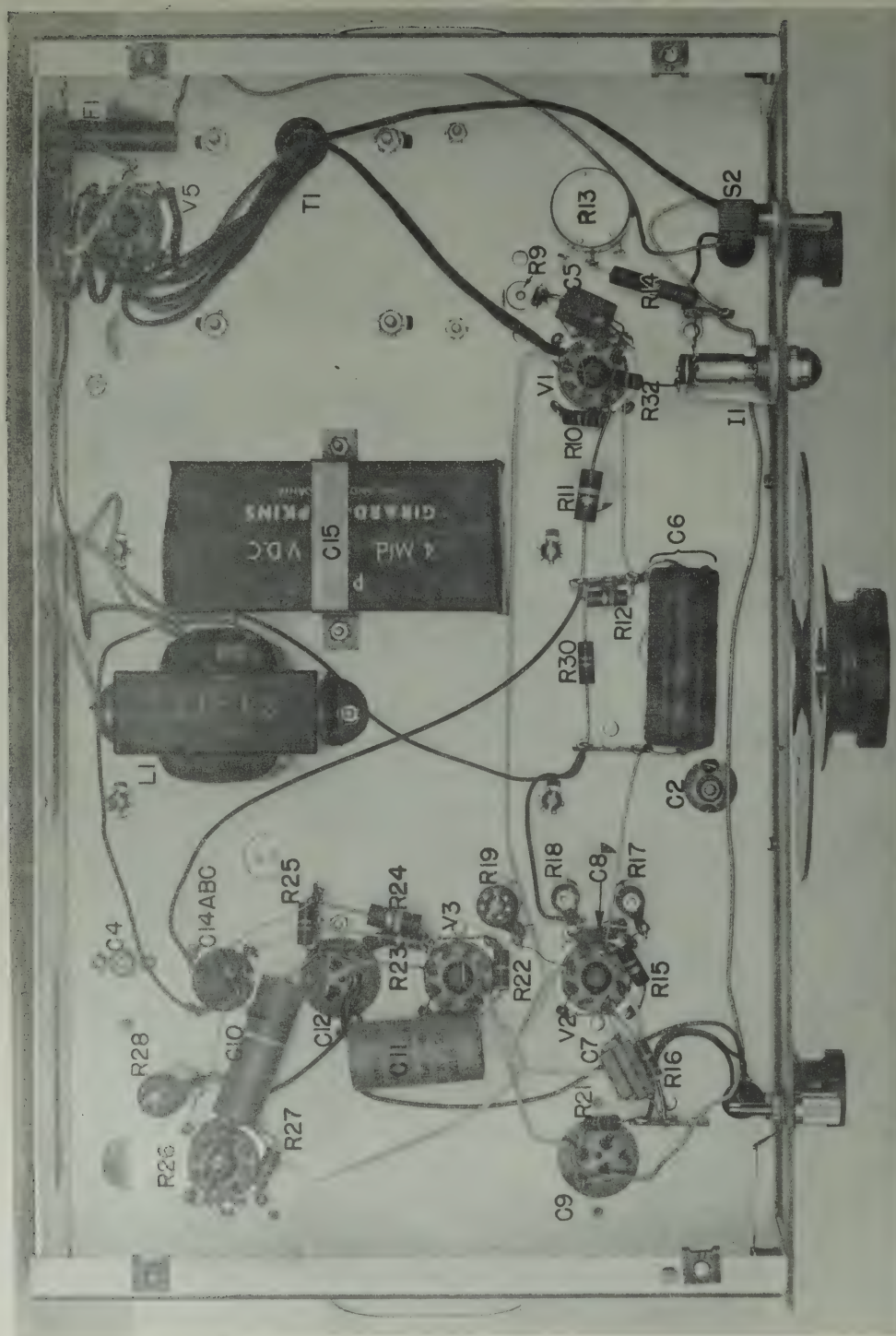
SCHEMATIC DIAGRAM OF MODEL 200D AUDIO OSCILLATOR  
SERIAL 70000 TO







Model 200D Top View  
Cover Removed



Model 200D Bottom View  
Bottom Plate Removed

TABLE OF REPLACEABLE PARTS

Circuit Ref.	Description	-hp- Stock No.	Mfr* & Mfrs. Designation
C1 **	Capacitor: fixed, mica, 82 $\mu\text{f}$ , $\pm 5\%$	15-7	K CI-3
C2 **	Capacitor: variable, air, 100 $\mu\text{f}$	12-11	AA, A-103L
C3 **	Capacitor: variable, air, 4 sect. 525 $\mu\text{f}$ /section, C3 is composed of two 4 section capacitors	12-6	HP
C4 **	Capacitor: variable, air, 100 $\mu\text{f}$	12-11	AA, A-103L
C5	Capacitor: fixed, mica, 100 $\mu\text{f}$ Electrical value adjusted at factory	14-100	V Type OXM
C6	Capacitor: fixed, paper, .5 $\mu\text{f}$ , 600 vdcw	16-5	A Type 684
C7	Capacitor: fixed, mica, 2000 $\mu\text{f}$ Capacitor: fixed, mica, 500 $\mu\text{f}$ C7 = 2000 $\mu\text{f}$ and 500 $\mu\text{f}$ in parallel	14-13 14-500	V, Type W V, Type OXM
C8	This circuit reference not assigned		
C9	Capacitor: fixed, electrolytic, 40 $\mu\text{f}$ , 450 vdcw	18-40	X FPS-146
C10	Capacitor: fixed, paper, .1 $\mu\text{f}$ , 600 vdcw	16-1	A Type P688
C11	Capacitor: fixed, electrolytic, 10 $\mu\text{f}$ , 450 vdcw	18-10	X WB 72
C12	Capacitor: fixed, electrolytic, 40 $\mu\text{f}$ , 450 vdcw	18-40	X FPS-146
C13	This circuit reference not assigned		
C14 abcd	Capacitor: fixed, electrolytic, 20, 20, 20, 20 $\mu\text{f}$ , 450 vdcw	18-42	X FPQ-444
C15	Capacitor: fixed, paper, 4 $\mu\text{f}$ , 600 vdcw	17-3	P P8-4

\*See "List of Manufacturers Code Letters For Replaceable Parts Table."

\*\* These parts are also included in Capacitor Assembly, #D-7



TABLE OF REPLACEABLE PARTS

Circuit Ref.	Description	-hp- Stock No.	Mfr.* & Mfrs. Designation
C16 **	Capacitor: fixed, mica, 51 $\mu$ f, $\pm 5\%$	15-6	K CI-3
R1-R8	Part of Range Switch Assembly		
R9	Lamp: 6W, 120V, S6 clear bulb, Candelabra screw base	211-5	N
R10	Resistor: fixed, composition, 47,000 ohms, $\pm 10\%$ , 1W	24-47K	B GB 4731
R11	Resistor: fixed, composition, 100,000 ohms, $\pm 10\%$ , 2W	25-100K	B HB 1041
R12	Resistor: fixed, composition, 56,000 ohms, $\pm 10\%$ , 1W	24-56K	B GB 5631
R13	Resistor: variable, wirewound, 1000 ohms, linear taper	210-5	G 21-010-355
R14	Resistor: fixed, wirewound, 1500 ohms, $\pm 10\%$ , 1W	26-1500	R Type BW
R15	Resistor: fixed, composition, 560,000 ohms, $\pm 10\%$ , 1W	24-560K	B GB 5641
R16	Resistor: fixed, wirewound, 500 ohms, $\pm 10\%$ , 10W	26-5	S Type 1-3/4E
R17	Resistor: fixed, wirewound, 25,000 ohms, $\pm 10\%$ , 10W	26-11	S Type 1-3/4E
R18	Resistor: fixed, wirewound, 10,000 ohms, $\pm 10\%$ , 10W	26-10	S Type 1-3/4E
R19	Resistor: fixed, wirewound, 10,000 ohms, $\pm 10\%$ , 20W	27-4	S Type 2R
R20	Resistor: variable, composition, 25,000 ohms, linear taper	210-54	B JU 2531
R21	Resistor: fixed, composition, 10,000 ohms, $\pm 10\%$ , 1W	24-10K	B GB 1031
R22	Resistor: fixed, composition, 4700 ohms, $\pm 10\%$ , 1W	24-4700	B GB 4721

\*See "List of Manufacturers Code Letters For Replaceable Parts Table."

# INSTRUCTION MANUAL CHANGES

MODEL 200CD/CDR

WIDE RANGE OSCILLATOR

Serial 8739 and above:

ERRATA R12: change to resistor, fixed, composition, 2700 ohms  
 $\pm 10\%$ , 1 W; -hp- Stock No. 24-2700; Mfr., B

V5: change to tube, electron, 5Y3GT or 5AR4;  
-hp- Stock No. 212-5Y3GT or 212-5AR4; Mfr., ZZ  
Either type may be used for replacement.

Serial 19750 and above:

C4: change to capacitor, fixed, silver mica, 39uuf  $\pm 2\%$ ,  
500 vdcw; -hp- Stock No. 15-164; Mfr., V

1/5/59

11/15/58

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TABLE OF REPLACEABLE PARTS

Circuit Ref.	Description	-hp- Stock No.	Mfr* & Mfrs. Designation
R23	Resistor: fixed, composition, 47,000 ohms, $\pm 10\%$ , 1W	24-47K	B GB 4731
R24	Resistor: fixed, composition, 100,000 ohms, $\pm 10\%$ , 2W	25-100K	B HB 1041
R25	Resistor: fixed, composition, 56,000 ohms, $\pm 10\%$ , 1W	24-56K	B GB 5631
R26	Resistor: fixed, composition, 560,000 ohms, $\pm 10\%$ , 1W	24-560K	B GB 5641
R27	Resistor: fixed, wirewound, 500 ohms, $\pm 10\%$ , 10W	26-5	S Type 1-3/4E
R28	Resistor: fixed, wirewound, 5000 ohms, $\pm 10\%$ , 20W	27-3	S Type 2R
R29	Resistor: fixed, composition, 10,000 ohms, $\pm 10\%$ , 1W	24-10K	B GB 1031
R30	Resistor: fixed, composition, 10,000 ohms, $\pm 10\%$ , 1W	24-10K	B GB 1031
R31	Resistor: fixed, composition, 10,000 ohms, $\pm 10\%$ , 1W	24-10K	B GB 1031
R32, R33, R34	These circuit references not assigned		
R35	Resistor: fixed, composition, 33 ohms, $\pm 10\%$ , 1W	24-33	B GB 3301
	"Ampl." Dial:	35-1	HP
	"Range" Dial:	35-10	HP
	Dial Window:	M-2	HP
	Binding Post:	312-3	HP
C1, C2, C3, C4, C16	Capacitor Assembly:	D-7	HP
	Fixed Coupling:	M-25	HP

\*See "List of Manufacturers Code Letters For Replaceable Parts Table."

TABLE OF REPLACEABLE PARTS

Circuit Ref.	Description	-hp- Stock No.	Mfr.* & Mfrs. Designation
F1	Fuse: 1 A, 3 AG type	211-1	T, #312001
	Fuseholder:	312-8	T, #342001
	Indicator Lamp Assembly:	312-10	BB, #807BS
	Knob: 1-1/2" diam.	37-11	HP
	Knob: 3" diam.	37-14	HP
I1	Lamp: 6-8V, .15A, miniature bayonet base	211-47	O, Mazda#47
	Lampholder: for R9	38-89	Leecraft Mfg. 659-1
P1	Power Cable:	812-56	HP
L1	Reactor: 6 H @ 125 MA, 240 ohms	911-12	HP
S1, R1-R8	Range Switch Assembly:	D-19W	HP
S2	Toggle Switch: SPST	310-11	D, #20994HW
T1	Power Transformer:	910-3	HP
V1	Tube: 6J7	212-6J7	ZZ
V2	Tube: 6F6	212-6F6	ZZ
V3	Tube: 6J7	212-6J7	ZZ
V4	Tube: 6V6	212-6V6	ZZ
V5	Tube: 5Y3GT	212-5Y3GT	ZZ

\*See "List of Manufacturers Code Letters For Replaceable Parts Table."

LIST OF MANUFACTURERS CODE LETTERS  
FOR REPLACEABLE PARTS TABLE

<u>Code Letter</u>	<u>Manufacturer</u>
A	Aerovox Corp.
B	Allen-Bradley Co.
C	Amperite Co.
D	Arrow, Hart and Hegeman
E	Bussman Manufacturing Co.
F	Carborundum Co.
G	Centralab
H	Cinch Manufacturing Co.
I	Clarostat Manufacturing Co.
J	Cornell Dubilier Electric Co.
K	Electrical Reactance Co.
L	Erie Resistor Corp.
M	Federal Telephone and Radio Corp.
N	General Electric Co.
O	General Electric Supply Corp.
P	Girard-Hopkins
HP	Hewlett-Packard
Q	Industrial Products Co.
R	International Resistance Co.
S	Lectrohm, Inc.
T	Littelfuse, Inc.
U	Maguire Industries, Inc.
V	Micamold Radio Corp.
W	Oak Mfg. Co.
X	P. R. Mallory Co., Inc.
Y	Radio Corp. of America
Z	Sangamo Electric Co.
AA	Sarkes Tarzian
BB	Signal Indicator Co.
CC	Sprague Electric Co.
DD	Stackpole Carbon Co.
EE	Sylvania Electric Products, Inc.
FF	Western Electric Co.
GG	Wilkor Products, Inc.
HH	Amphenol
II	Dial Light Co. of America
JJ	Leecraft Manufacturing Co.
ZZ	Any tube having RMA standard characteristics



## CLAIM FOR DAMAGE IN SHIPMENT

The instrument should be tested as soon as it is received. If it fails to operate properly, or is damaged in any way, a claim should be filed with the carrier. A full report of the damage should be obtained by the claim agent, and this report should be forwarded to us. We will then advise you of the disposition to be made of the equipment and arrange for repair or replacement. Include model number, type number and serial number when referring to this instrument for any reason.

## WARRANTY

Hewlett-Packard Company warrants each instrument manufactured by them to be free from defects in material and workmanship. Our liability under this warranty is limited to servicing or adjusting any instrument returned to the factory for that purpose and to replace any defective parts thereof (except tubes, fuses and batteries). This warranty is effective for one year after delivery to the original purchaser when the instrument is returned, transportation charges prepaid by the original purchaser, and which upon our examination is disclosed to our satisfaction to be defective. If the fault has been caused by misuse or abnormal conditions of operation, repairs will be billed at cost. In this case, an estimate will be submitted before the work is started.

If any fault develops, the following steps should be taken:

1. Notify us, giving full details of the difficulty, and include the model number, type number and serial number. On receipt of this information, we will give you service instructions or shipping data.
2. On receipt of shipping instructions, forward the instrument prepaid, and repairs will be made at the factory. If requested, an estimate of the charges will be made before the work begins provided the instrument is not covered by the warranty.

## SHIPPING

All shipments of Hewlett-Packard instruments should be made via Railway Express. The instruments should be packed in a wooden box and surrounded by two to three inches of excelsior or similar shock-absorbing material.

**DO NOT HESITATE TO CALL ON US**

**HEWLETT-PACKARD COMPANY**

*Laboratory Instruments for Speed and Accuracy*

395 PAGE MILL ROAD

PALO ALTO, CALIF.









LIST OF MANUFACTURERS CODE LETTERS  
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B	Allen-Bradley Co.
C	Amperite Co.
D	Arrow, Hart and Hegeman
E	Bussman Manufacturing Co.
F	Carborundum Co.
G	Centralab
H	Cinch Manufacturing Co.
I	Clarostat Manufacturing Co.
J	Cornell Dubilier Electric Co.
K	Electrical Reactance Co.
L	Erie Resistor Corp.
M	Federal Telephone and Radio Corp.
N	General Electric Co.
O	General Electric Supply Corp.
P	Girard-Hopkins
HP	Hewlett-Packard
Q	Industrial Products Co.
R	International Resistance Co.
S	Lectrohm, Inc.
T	Littelfuse, Inc.
U	Maguire Industries, Inc.
V	Micamold Radio Corp.
W	Oak Mfg. Co.
X	P. R. Mallory Co., Inc.
Y	Radio Corp. of America
Z	Sangamo Electric Co.
AA	Sarkes Tarzian
BB	Signal Indicator Co.
CC	Sprague Electric Co.
DD	Stackpole Carbon Co.
EE	Sylvania Electric Products, Inc.
FF	Western Electric Co.
GG	Wilkor Products, Inc.
HH	Amphenol
II	Dial Light Co. of America
JJ	Leecraft Manufacturing Co.
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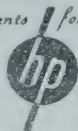


TABLE OF REPLACEABLE PARTS

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R25	Resistor: fixed, composition, 56,000 ohms, $\pm 10\%$ , 1W	24-56K	B GB 5631
R26	Resistor: fixed, composition, 560,000 ohms, $\pm 10\%$ , 1W	24-560K	B GB 5641
R27	Resistor: fixed, wirewound, 500 ohms, $\pm 10\%$ , 10W	26-5	S Type 1-3/4E
R28	Resistor: fixed, wirewound, 5000 ohms, $\pm 10\%$ , 20W	27-3	S Type 2R
R29	Resistor: fixed, composition, 10,000 ohms, $\pm 10\%$ , 1W	24-10K	B GB 1031
R30	Resistor: fixed, composition, 10,000 ohms, $\pm 10\%$ , 1W	24-10K	B GB 1031
R31	Resistor: fixed, composition, 10,000 ohms, $\pm 10\%$ , 1W	24-10K	B GB 1031
R32, R33, R34	These circuit references not assigned		
R35	Resistor: fixed, composition, 33 ohms, $\pm 10\%$ , 1W	24-33	B GB 3301
	"Ampl." Dial:	35-1	HP
	"Range" Dial:	35-10	HP
	Dial Window:	M-2	HP
	Binding Post:	312-3	HP
C1, C2, C3, C4, C16	Capacitor Assembly:	D-7	HP
	Fixed Coupling:	M-25	HP

\*See "List of Manufacturers Code Letters For Replaceable Parts Table."

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Circuit Ref.	Description	-hp- Stock No.	Mfr.* & Mfrs. Designation
F1	Fuse: 1 A, 3 AG type	311-1	T, #312001
	Fuseholder:	312-8	T, #342001
	Indicator Lamp Assembly:	312-10	BB, #807BS
	Knob: 1-1/2" diam.	37-11	HP
	Knob: 3" diam.	37-14	HP
I1	Lamp: 6-8V, .15A, miniature bayonet base	211-47	O, Mazda#47
	Lampholder: for R9	38-89	Leecraft <sup>+</sup> Mfg. 659-1
P1	Power Cable:	312-56	HP
L1	Reactor: 6 H @ 125 MA, 240 ohms	911-12	HP
S1, R1-R8	Range Switch Assembly:	D-19W	HP
S2	Toggle Switch: SPST	310-11	D, #20994HW
T1	Power Transformer:	910-3	HP
V1	Tube: 6J7	212-6J7	ZZ
V2	Tube: 6F6	212-6F6	ZZ
V3	Tube: 6J7	212-6J7	ZZ
V4	Tube: 6V6	212-6V6	ZZ
V5	Tube: 5Y3GT	212-5Y3GT	ZZ

\*See "List of Manufacturers Code Letters For Replaceable Parts Table."



TABLE OF REPLACEABLE PARTS

Circuit Ref.	Description	-hp- Stock No.	Mfr.* & Mfrs. Designation
C1 **	Capacitor: fixed, mica, 82 $\mu\text{f}$ , $\pm 5\%$	15-7	K CI-3
C2 **	Capacitor: variable, air, 100 $\mu\text{f}$	12-11	AA, A-103L
C3 **	Capacitor: variable, air, 4 sect. 525 $\mu\text{f}$ /section, C3 is composed of two 4 section capacitors	12-6	HP
C4 **	Capacitor: variable, air, 100 $\mu\text{f}$	12-11	AA, A-103L
C5	Capacitor: fixed, mica, 100 $\mu\text{f}$ Electrical value adjusted at factory	14-100	V Type OXM
C6	Capacitor: fixed, paper, .5 $\mu\text{f}$ , 600 vdcw	16-5	A Type 684
C7	Capacitor: fixed, mica, 2000 $\mu\text{f}$ Capacitor: fixed, mica, 500 $\mu\text{f}$ C7 = 2000 $\mu\text{f}$ and 500 $\mu\text{f}$ in parallel	14-13 14-500	V, Type W V, Type OXM
C8	This circuit reference not assigned		
C9	Capacitor: fixed, electrolytic, 40 $\mu\text{f}$ , 450 vdcw	18-40	X FPS-146
C10	Capacitor: fixed, paper, .1 $\mu\text{f}$ , 600 vdcw	16-1	A Type P688
C11	Capacitor: fixed, electrolytic, 10 $\mu\text{f}$ , 450 vdcw	18-10	X WB 72
C12	Capacitor: fixed, electrolytic, 40 $\mu\text{f}$ , 450 vdcw	18-40	X FPS-146
C13	This circuit reference not assigned		
C14 abcd	Capacitor: fixed, electrolytic, 20, 20, 20, 20 $\mu\text{f}$ , 450 vdcw	18-42	X FPQ-444
C15	Capacitor: fixed, paper, 4 $\mu\text{f}$ , 600 vdcw	17-3	P P8-4

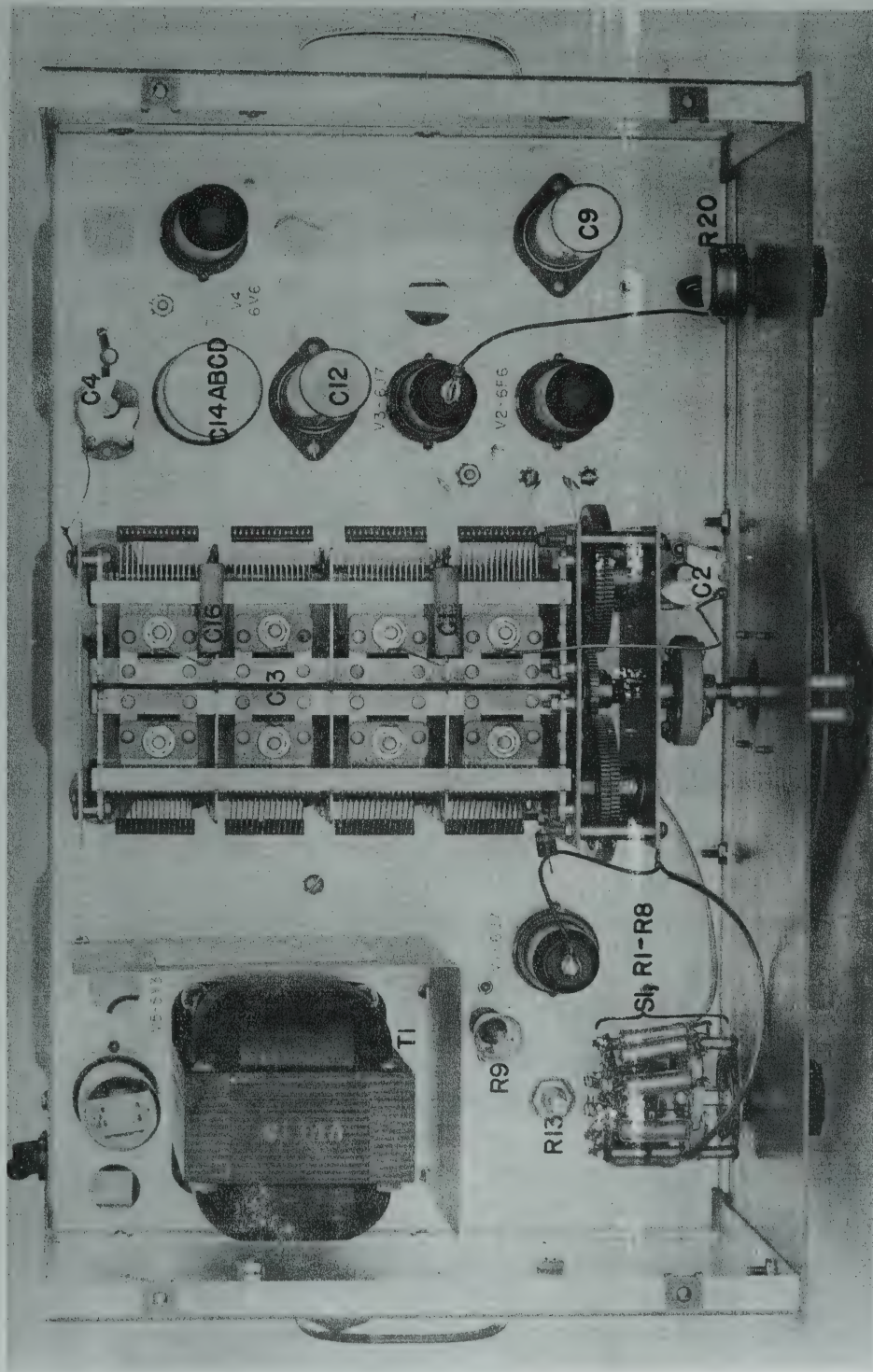
\*See "List of Manufacturers Code Letters For Replaceable Parts Table."

\*\* These parts are also included in Capacitor Assembly, #D-7

TABLE OF REPLACEABLE PARTS

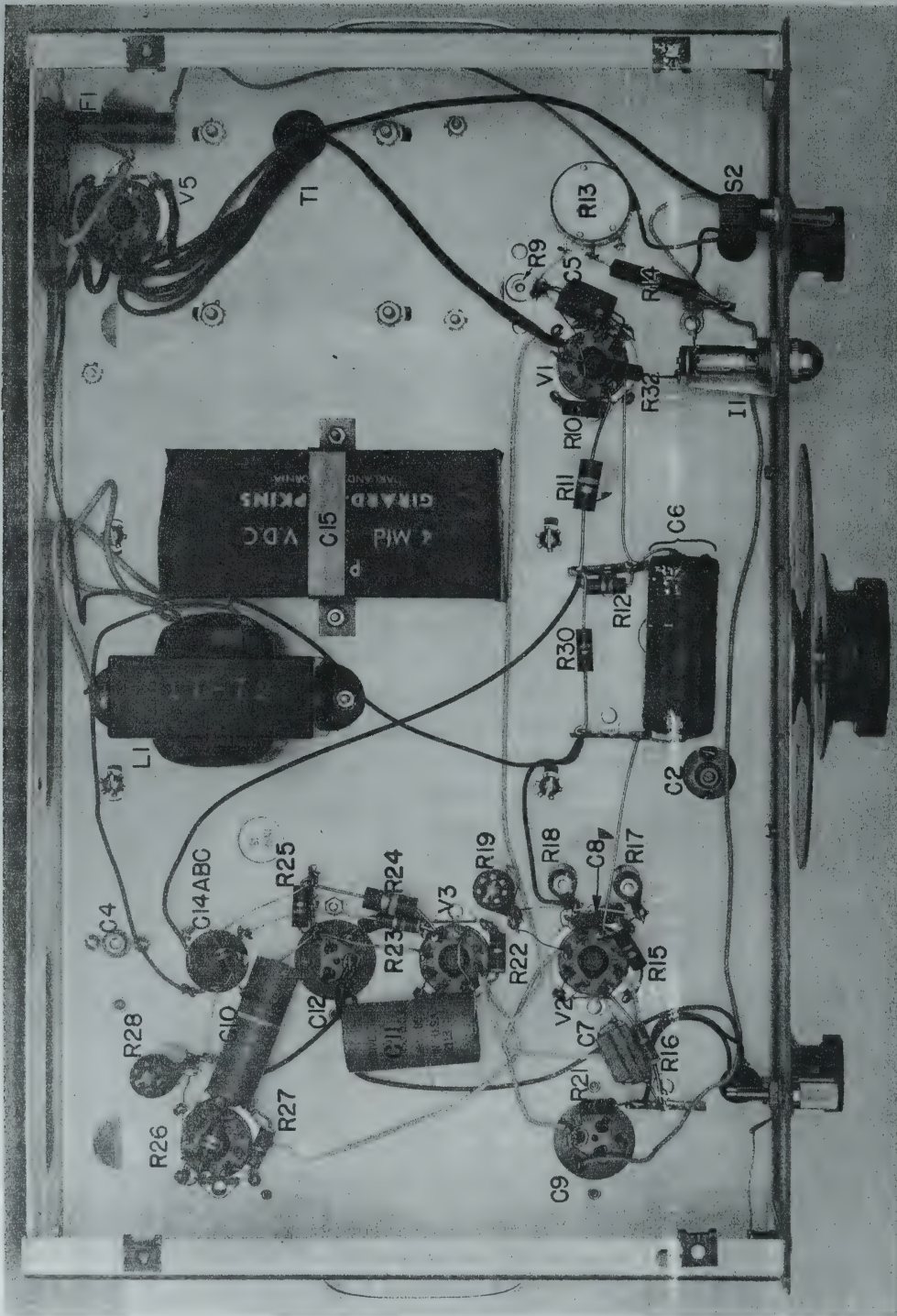
Circuit Ref.	Description	-hp- Stock No.	Mfr.* & Mfrs. Designation
C16 **	Capacitor: fixed, mica, 51 $\mu$ f, $\pm 5\%$	15-6	K CI-3
R1-R8	Part of Range Switch Assembly		
R9	Lamp: 6W, 120V, S6 clear bulb, Candelabra screw base	211-5	N
R10	Resistor: fixed, composition, 47,000 ohms, $\pm 10\%$ , 1W	24-47K	B GB 4731
R11	Resistor: fixed, composition, 100,000 ohms, $\pm 10\%$ , 2W	25-100K	B HB 1041
R12	Resistor: fixed, composition, 56,000 ohms, $\pm 10\%$ , 1W	24-56K	B GB 5631
R13	Resistor: variable, wirewound, 1000 ohms, linear taper	210-5	G 21-010-355
R14	Resistor: fixed, wirewound, 1500 ohms, $\pm 10\%$ , 1W	26-1500	R Type BW
R15	Resistor: fixed, composition, 560,000 ohms, $\pm 10\%$ , 1W	24-560K	B GB 5641
R16	Resistor: fixed, wirewound, 500 ohms, $\pm 10\%$ , 10W	26-5	S Type 1-3/4E
R17	Resistor: fixed, wirewound, 25,000 ohms, $\pm 10\%$ , 10W	26-11	S Type 1-3/4E
R18	Resistor: fixed, wirewound, 10,000 ohms, $\pm 10\%$ , 10W	26-10	S Type 1-3/4E
R19	Resistor: fixed, wirewound, 10,000 ohms, $\pm 10\%$ , 20W	27-4	S Type 2R
R20	Resistor: variable, composition, 25,000 ohms, linear taper	210-54	B JU 2531
R21	Resistor: fixed, composition, 10,000 ohms, $\pm 10\%$ , 1W	24-10K	B GB 1031
R22	Resistor: fixed, composition, 4700 ohms, $\pm 10\%$ , 1W	24-4700	B GB 4721

\*See "List of Manufacturers Code Letters For Replaceable Parts Table."



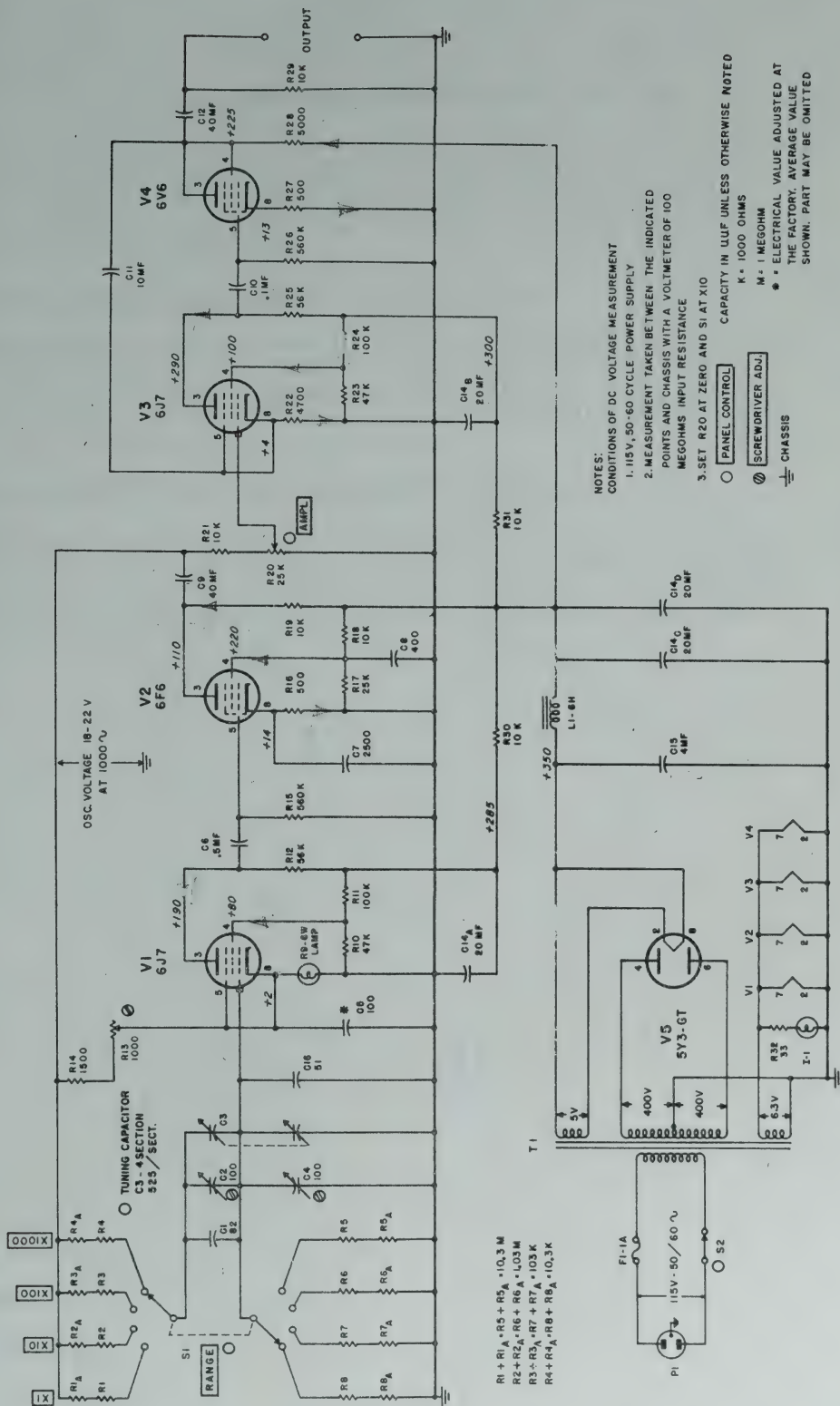
Model 200D Top View  
Cover Removed





Model 200D Bottom View  
Bottom Plate Removed





SCHEMATIC DIAGRAM OF MODEL 200D AUDIO OSCILLATOR  
SERIAL 70000 TO



## INSTRUCTIONS FOR RECTIFIER TUBE REPLACEMENT

These instructions apply to any Hewlett-Packard instrument in which a 5V4 tube is mounted in the power rectifier tube socket. When it is necessary to replace the rectifier tube, a 5Y3GT tube may be used as a replacement if the following instructions are followed.

### INSTRUMENTS WITH DC VOLTAGE REGULATOR CIRCUIT -

The 5V4 tube may be replaced by a 5Y3GT tube without any circuit changes. After the 5Y3GT tube has been installed, the regulated voltage should be measured to see if it agrees with the voltage shown on the schematic wiring diagram in the instruction book. If the regulated voltage is incorrect, it may be corrected by following the instructions in the instruction book.

### INSTRUMENTS WITHOUT DC VOLTAGE REGULATOR CIRCUIT -

The 5V4 tube may be replaced by a 5Y3GT tube providing the resistor, in series with the DC output of the rectifier, is removed. This resistor does not appear in the schematic wiring diagram in the instruction book. The following instruments use a 500 ohms series resistor: Models 200C, 200D, 202D, 210A, 300BCD, and the 400A.





### Replacement of Lamp R9 --

The 6-watt lamp R9 is operated at a very low level and should have an almost infinite life. Therefore, the lamp should not be changed indiscriminately. However, should the lamp require changing, it is necessary to check the ac voltage from the junction of R21 and C9 to ground with the new lamp in the circuit. As measured with a high-impedance ac vacuum tube voltmeter, this voltage should be within the range of approximately 18-22 volts when the Model 200D is tuned to 1000 cps. If the voltage is not within this range, it may be corrected by adjusting R13.

If the voltage cannot be brought within the range from 18 to 22 volts by means of R13, the new lamp should be rejected in favor of another.

### Intermittent Output --

"Jumpy" or intermittent output accompanied by flashing of the 6 watt oscillator lamp (R9) is a reliable indication of a short in trimmer capacitor C2 (mounted on gear drive) or in the four front (nearest the panel) sections of the main tuning capacitor. If these symptoms occur, search out and clear the short with a weak air jet or other means. Do not bend the capacitor plates because bending capacitor plates will destroy the frequency calibration.

A short in the four rear sections of the main tuning capacitor or in trimmer C4 (mounted on chassis at rear end of tuning capacitor) will prevent the circuit from oscillating. Any such short should be cleared as explained above.

### Distortion --

Distortion may be caused by defective tubes, electrical leakage in the coupling capacitors, defective electrolytic capacitors, low DC supply voltage, or excessive output voltage from the oscillator section.

### Frequency Calibration --

If a change occurs in the frequency calibration, the instrument should be returned to the Hewlett-Packard Co. for re-calibration.

## Trouble Shooting --

The following is a listing of possible symptoms, causes and remedies.

<u>Symptoms</u>	<u>Causes</u>	<u>Remedies</u>
Instrument inoperative (Indicator light won't light, no audio output)	Blown fuse	Clear short circuit and replace fuse.
Instrument inoperative (Indicator lamp lights, no audio output)	Defective tube Check 5Y3GT tube.	Replace tube (See "Tube Replacement" in Main- tenance section).
	Short circuit in DC power circuit capacitor	Replace capacitor
	Short circuit in C3 (four rear sections) or C4	Clear the short circuit as outlined in the "Intermit- tent Output" paragraph in the Maintenance section.
Intermittent Output	Short circuit in C3 (four front sections) or C2	Clear the short circuit as outlined in the "Intermit- tent Output" paragraph in the Maintenance section.
	Capacitor C6, C9, C10 or C11 intermittently open	Replace capacitor
Excessive Distortion	Defective tube	Replace tube (See "Tube Replacement" in Main- tenance section).
	Open capacitor C11, C14abcd or C15	Replace capacitor
	Leaking capacitor C6, C9, C10, C11, or C12	Replace capacitor

## Operation --

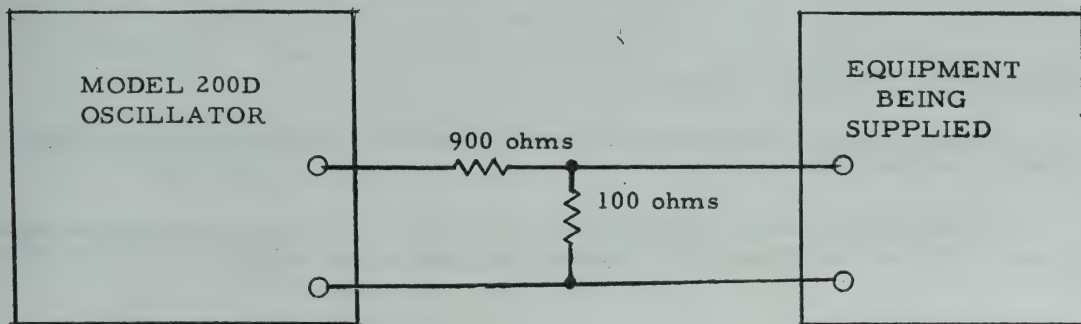
Plug the power cable of the Model 200D into a 115 volts, 50/60 cycles power source and turn on the AC power switch. The instrument will begin to operate as soon as the tubes have heated, but for maximum accuracy a warm-up period of about 30 minutes is necessary.

Set the frequency dial and RANGE switch so that their indications, when multiplied together, equal the desired frequency. For example, if it is desired to select an output frequency of 1000 cycles per second, set the frequency dial to 10 and the RANGE switch to  $\times 10$ .

Connect the output of the oscillator to the equipment being driven and adjust the AMPL. control for the desired output voltage.

Although the rated load for the Model 200D is 1000 ohms, higher or lower impedance loads may be used without damage to the instrument. A higher impedance load will result in less power output and a lower impedance load will increase the percentage of distortion in the output voltage.

As the output voltage of the audio oscillator is reduced, the percentage of hum voltage will increase. At the lower levels this hum voltage becomes quite large, relative to the sine wave output voltage. This undesirable condition can be remedied by operating the audio oscillator at or slightly below rated output and inserting a suitable attenuator between the oscillator and the equipment being driven by the oscillator. The voltage divider circuit shown next is satisfactory for most applications.



Other values of resistance may be used to obtain different voltage divisions. In all cases, the sum of the divider resistors should match the rated load of 1000 ohms.

## Circuit Description

The Model 200D Audio Oscillator consists of an oscillator section, an amplifier section, and a conventional power supply.

The oscillator section (tubes V1 and V2) is a resistance-tuned type circuit. Basically, this oscillator is a two-stage resistance-coupled amplifier which is caused to oscillate by the use of a positive feedback network. This network is a frequency-selective resistance-capacity combination which controls the frequency of oscillation. By using a variable tuning condenser for the capacity of the network, it is possible to tune the oscillator over a wide 10:1 range; and by using a switching arrangement to select different values of resistance for the network, several ranges are given to the oscillator.

Negative feedback is used in the oscillator section in order to minimize distortion and to obtain a very high order of stability. The amount of negative feedback is determined by a resistance network, one element of which is non-linear (the 6-watt lamp in the cathode of V1). This element controls the amount of feedback in accordance with the amplitude of oscillation and consequently maintains the amplitude of oscillation substantially constant over a wide frequency range. The negative feedback also keeps the operation of the system on the linear portion of the tube characteristics. It is notable that the lamp has sufficient thermal inertia so that it operates well even at low frequencies.

Following the oscillator is the output amplifier section which includes tubes V3 and V4. Negative feedback is used in the amplifier in order to minimize distortion and to provide a good frequency response.

## Maintenance

### Cover and Bottom Plate Removal --

The cover is removed by unscrewing the eight screws which fasten the cover to the back and top of the instrument.

The bottom plate is removed by unscrewing the four screws, one in each corner of the bottom plate, which fasten the plate to the chassis.

### Tube Replacement --

When replacing any of the tubes except the power rectifier, it is desirable to measure the distortion in the output if maximum performance from the instrument is desired, because a poor tube can cause excessive distortion without seemingly affecting the operation. The distortion should be less than 1% of the rated output with rated load from 10 to 70,000 cycles. Distortion may also be caused by leaking coupling capacitors and open by-pass capacitors.



# INSTRUCTIONS

## MODEL 200D

### AUDIO OSCILLATOR

#### Specifications

##### Frequency Rating --

Frequency Range - 7 to 7000 cycles/sec.

Frequency Dial Calibration - 7 to 70

Range -

x1	7 to 70 cycles/sec.
x10	70 to 700 cycles/sec.
x100	700 to 7000 cycles/sec.
x1000	7000 to 70,000 cycles/sec.

Calibration Accuracy -  $\pm 2\%$

Frequency Response -  $\pm 1$  db - 7 to 70,000 cycles/sec. Reference:  
10 volts at 1000 cycles/sec. into 1000 ohms load.

Frequency Stability -  $\pm 2\%$  under the normal temperature conditions  
including initial warm-up drift.  $\pm 10\%$  line voltage variations will  
change the frequency less than  $\pm .2\%$  at 1000 cycles/sec.

##### Power Output Rating --

Power Output - 100 milliwatts into rated load. (10 volts into a 1000  
ohms load).

Distortion - Less than 1% of rated output, 10 to 70,000 cycles/sec.

Hum voltage - Less than .1% of rated output.

Load Impedance - 1000 ohms, resistive

Internal Impedance - Approximately 25 ohms, 70 to 70,000 cycles/sec.

One side of output grounded.

##### Power Supply Rating --

Voltage - 105 to 125 volts

Frequency - 50/60 cycles

Wattage - 80 watts

##### Overall Dimensions --

Rack Model - 19" wide x 8-3/4" high x 12-1/4" deep

Panel - 19" x 8-3/4", Depth behind panel - 10-1/2"

Cabinet Model - 18-3/4" wide x 8-3/4" high x 12" deep

Weight --

Cabinet Model - 25 pounds

Rack Model - 27 pounds

Operating Instructions

Inspection --

This instrument has been thoroughly tested and inspected before being shipped and is ready for use when received.

After the instrument is unpacked, the instrument should be carefully inspected for damage received in transit. If any shipping damage is found, follow the procedure outlined in the "Claim for Damage in Shipment" page at the back of this instruction book.

Controls and Terminals --

AC Power - This toggle switch, which is located in the lower left corner of the control panel, controls the power supplied to the instrument from the power line. When the switch is in the ON position, the red indicator will glow.

FUSE - The fuseholder, located on the back of the chassis, contains a one ampere cartridge fuse. The fuse may be replaced by unscrewing the fuseholder cap and inserting a new fuse.

RANGE - This rotary switch inserts various range resistors in the frequency determining circuit of the oscillator. The position of this switch indicates the multiplying factor for the frequency dial calibration and which frequency dial scale should be used.

Frequency Dial - The frequency dial is calibrated directly in cycles per second for the lowest frequency range.

AMPL. - This variable resistor controls the amplitude of the oscillator voltage admitted to the amplifier and therefore the output voltage of the instrument.

Power Cable - The power cable consists of three conductors. Two of these conductors carry power to the instrument while the third conductor (green wire) is connected to the instrument chassis. The third wire projects from the cable near the plug end of the cable and may be connected to a ground when it is desirable to have a grounded instrument chassis.

Output Terminals - The two binding posts, in the lower right corner of the control panel, are the output terminals. The lower binding post is connected to the chassis.

INSTRUCTION AND OPERATING MANUAL  
FOR

MODEL 200D

AUDIO OSCILLATOR

Serial 70,000 and Above

HEWLETT-PACKARD COMPANY  
395 PAGE MILL ROAD, PALO ALTO, CALIFORNIA, U.S.A.









INSTRUCTION AND OPERATING MANUAL  
FOR

MODEL 200D

AUDIO OSCILLATOR

Serial 70,000 and Above

HEWLETT-PACKARD COMPANY  
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# INSTRUCTIONS

## MODEL 200D

### AUDIO OSCILLATOR

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Frequency Dial Calibration - 7 to 70

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x1	7 to 70 cycles/sec.
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x1000	7000 to 70,000 cycles/sec.

Calibration Accuracy -  $\pm 2\%$

Frequency Response -  $\pm 1$  db - 7 to 70,000 cycles/sec. Reference:  
10 volts at 1000 cycles/sec. into 1000 ohms load.

Frequency Stability -  $\pm 2\%$  under the normal temperature conditions  
including initial warm-up drift.  $\pm 10\%$  line voltage variations will  
change the frequency less than  $\pm .2\%$  at 1000 cycles/sec.

##### Power Output Rating --

Power Output - 100 milliwatts into rated load. (10 volts into a 1000  
ohms load).

Distortion - Less than 1% of rated output, 10 to 70,000 cycles/sec.

Hum voltage - Less than .1% of rated output.

Load Impedance - 1000 ohms, resistive

Internal Impedance - Approximately 25 ohms, 70 to 70,000 cycles/sec.  
One side of output grounded.

##### Power Supply Rating --

Voltage - 105 to 125 volts

Frequency - 50/60 cycles

Wattage - 80 watts

##### Overall Dimensions --

Rack Model - 19" wide x 8-3/4" high x 12-1/4" deep

Panel - 19" x 8-3/4", . Depth behind panel - 10-1/2"

Cabinet Model - 18-3/4" wide x 8-3/4" high x 12" deep

## Weight --

Cabinet Model - 25 pounds

Rack Model - 27 pounds

## Operating Instructions

### Inspection --

This instrument has been thoroughly tested and inspected before being shipped and is ready for use when received.

After the instrument is unpacked, the instrument should be carefully inspected for damage received in transit. If any shipping damage is found, follow the procedure outlined in the "Claim for Damage in Shipment" page at the back of this instruction book.

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Output Terminals - The two binding posts, in the lower right corner of the control panel, are the output terminals. The lower binding post is connected to the chassis.

## Operation --

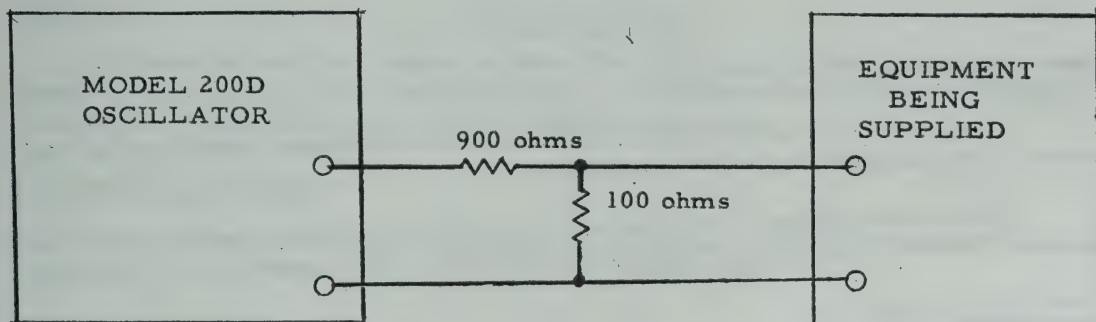
Plug the power cable of the Model 200D into a 115 volts, 50/60 cycles power source and turn on the AC power switch. The instrument will begin to operate as soon as the tubes have heated, but for maximum accuracy a warm-up period of about 30 minutes is necessary.

Set the frequency dial and RANGE switch so that their indications, when multiplied together, equal the desired frequency. For example, if it is desired to select an output frequency of 1000 cycles per second, set the frequency dial to 10 and the RANGE switch to x10.

Connect the output of the oscillator to the equipment being driven and adjust the AMPL. control for the desired output voltage.

Although the rated load for the Model 200D is 1000 ohms, higher or lower impedance loads may be used without damage to the instrument. A higher impedance load will result in less power output and a lower impedance load will increase the percentage of distortion in the output voltage.

As the output voltage of the audio oscillator is reduced, the percentage of hum voltage will increase. At the lower levels this hum voltage becomes quite large, relative to the sine wave output voltage. This undesirable condition can be remedied by operating the audio oscillator at or slightly below rated output and inserting a suitable attenuator between the oscillator and the equipment being driven by the oscillator. The voltage divider circuit shown next is satisfactory for most applications.



Other values of resistance may be used to obtain different voltage divisions. In all cases, the sum of the divider resistors should match the rated load of 1000 ohms.



## Circuit Description

The Model 200D Audio Oscillator consists of an oscillator section, an amplifier section, and a conventional power supply.

The oscillator section (tubes V1 and V2) is a resistance-tuned type circuit. Basically, this oscillator is a two-stage resistance-coupled amplifier which is caused to oscillate by the use of a positive feedback network. This network is a frequency-selective resistance-capacity combination which controls the frequency of oscillation. By using a variable tuning condenser for the capacity of the network, it is possible to tune the oscillator over a wide 10:1 range; and by using a switching arrangement to select different values of resistance for the network, several ranges are given to the oscillator.

Negative feedback is used in the oscillator section in order to minimize distortion and to obtain a very high order of stability. The amount of negative feedback is determined by a resistance network, one element of which is non-linear (the 6-watt lamp in the cathode of V1). This element controls the amount of feedback in accordance with the amplitude of oscillation and consequently maintains the amplitude of oscillation substantially constant over a wide frequency range. The negative feedback also keeps the operation of the system on the linear portion of the tube characteristics. It is notable that the lamp has sufficient thermal inertia so that it operates well even at low frequencies.

Following the oscillator is the output amplifier section which includes tubes V3 and V4. Negative feedback is used in the amplifier in order to minimize distortion and to provide a good frequency response.

## Maintenance

### Cover and Bottom Plate Removal --

The cover is removed by unscrewing the eight screws which fasten the cover to the back and top of the instrument.

The bottom plate is removed by unscrewing the four screws, one in each corner of the bottom plate, which fasten the plate to the chassis.

### Tube Replacement --

When replacing any of the tubes except the power rectifier, it is desirable to measure the distortion in the output if maximum performance from the instrument is desired, because a poor tube can cause excessive distortion without seemingly affecting the operation. The distortion should be less than 1% of the rated output with rated load from 10 to 70,000 cycles. Distortion may also be caused by leaking coupling capacitors and open by-pass capacitors.



### Replacement of Lamp R9 --

The 6-watt lamp R9 is operated at a very low level and should have an almost infinite life. Therefore, the lamp should not be changed indiscriminately. However, should the lamp require changing, it is necessary to check the ac voltage from the junction of R21 and C9 to ground with the new lamp in the circuit. As measured with a high-impedance ac vacuum tube voltmeter, this voltage should be within the range of approximately 18-22 volts when the Model 200D is tuned to 1000 cps. If the voltage is not within this range, it may be corrected by adjusting R13.

If the voltage cannot be brought within the range from 18 to 22 volts by means of R13, the new lamp should be rejected in favor of another.

### Intermittent Output --

"Jumpy" or intermittent output accompanied by flashing of the 6 watt oscillator lamp (R9) is a reliable indication of a short in trimmer capacitor C2 (mounted on gear drive) or in the four front (nearest the panel) sections of the main tuning capacitor. If these symptoms occur, search out and clear the short with a weak air jet or other means. Do not bend the capacitor plates because bending capacitor plates will destroy the frequency calibration.

A short in the four rear sections of the main tuning capacitor or in trimmer C4 (mounted on chassis at rear end of tuning capacitor) will prevent the circuit from oscillating. Any such short should be cleared as explained above.

### Distortion --

Distortion may be caused by defective tubes, electrical leakage in the coupling capacitors, defective electrolytic capacitors, low DC supply voltage, or excessive output voltage from the oscillator section.

### Frequency Calibration --

If a change occurs in the frequency calibration, the instrument should be returned to the Hewlett-Packard Co. for re-calibration.

## Trouble Shooting --

The following is a listing of possible symptoms, causes and remedies.

<u>Symptoms</u>	<u>Causes</u>	<u>Remedies</u>
Instrument inoperative (Indicator light won't light, no audio output)	Blown fuse	Clear short circuit and replace fuse.
Instrument inoperative (Indicator lamp lights, no audio output)	Defective tube Check 5Y3GT tube.	Replace tube (See "Tube Replacement" in Main- tenance section).
	Short circuit in DC power circuit capacitor	Replace capacitor
	Short circuit in C3 (four rear sections) or C4	Clear the short circuit as outlined in the "Intermit- tent Output" paragraph in the Maintenance section.
Intermittent Output	Short circuit in C3 (four front sections) or C2	Clear the short circuit as outlined in the "Intermit- tent Output" paragraph in the Maintenance section.
	Capacitor C6, C9, C10 or C11 intermittently open	Replace capacitor
Excessive Distortion	Defective tube	Replace tube (See "Tube Replacement" in Main- tenance section).
	Open capacitor C11, C14abcd or C15	Replace capacitor
	Leaking capacitor C6, C9, C10, C11, or C12	Replace capacitor

## INSTRUCTIONS FOR RECTIFIER TUBE REPLACEMENT

These instructions apply to any Hewlett-Packard instrument in which a 5V4 tube is mounted in the power rectifier tube socket. When it is necessary to replace the rectifier tube, a 5Y3GT tube may be used as a replacement if the following instructions are followed.

### INSTRUMENTS WITH DC VOLTAGE REGULATOR CIRCUIT -

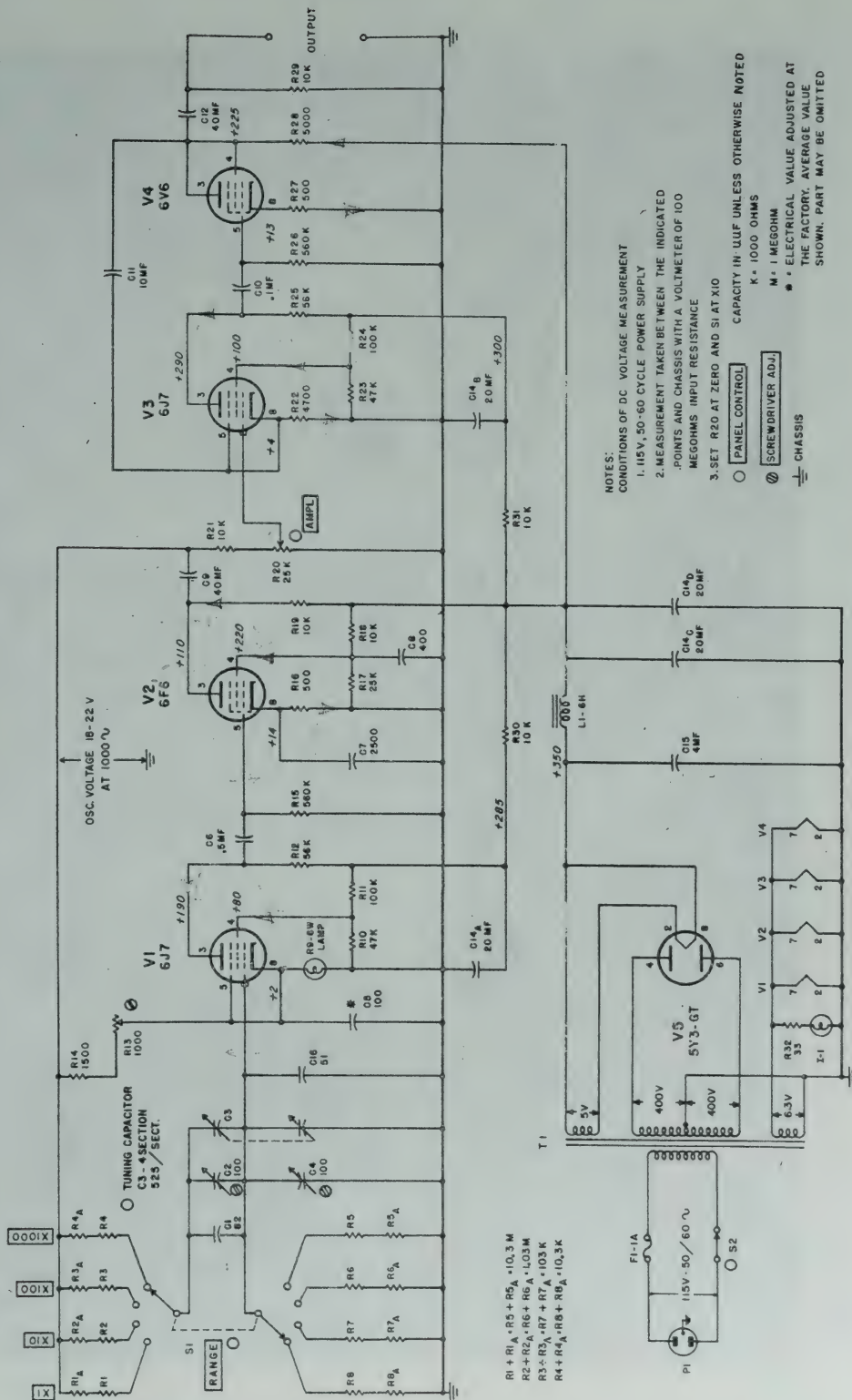
The 5V4 tube may be replaced by a 5Y3GT tube without any circuit changes. After the 5Y3GT tube has been installed, the regulated voltage should be measured to see if it agrees with the voltage shown on the schematic wiring diagram in the instruction book. If the regulated voltage is incorrect, it may be corrected by following the instructions in the instruction book.

### INSTRUMENTS WITHOUT DC VOLTAGE REGULATOR CIRCUIT -

The 5V4 tube may be replaced by a 5Y3GT tube providing the resistor, in series with the DC output of the rectifier, is removed. This resistor does not appear in the schematic wiring diagram in the instruction book. The following instruments use a 500 ohms series resistor: Models 200C, 200D, 202D, 210A, 300BCD, and the 400A.

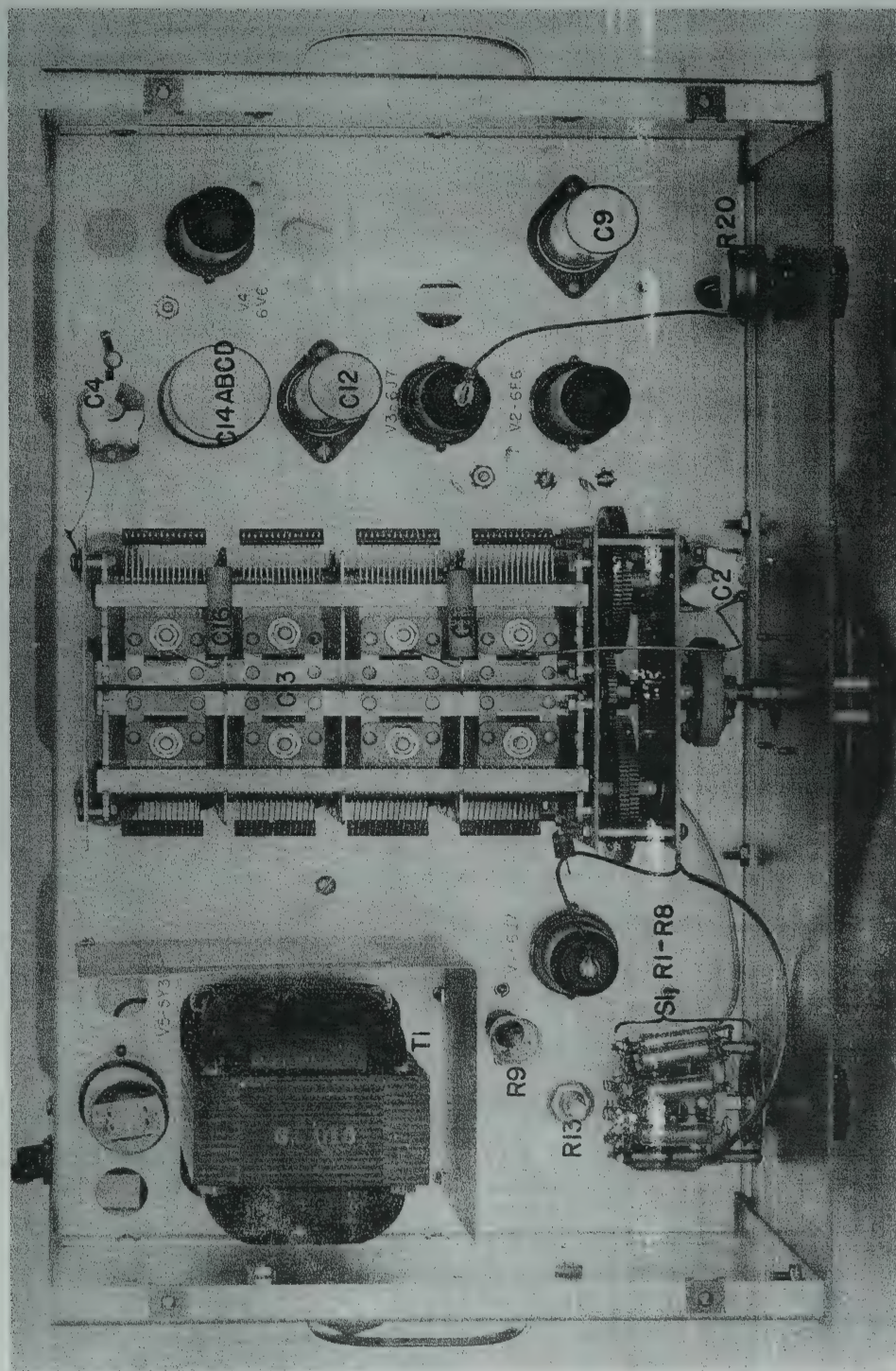






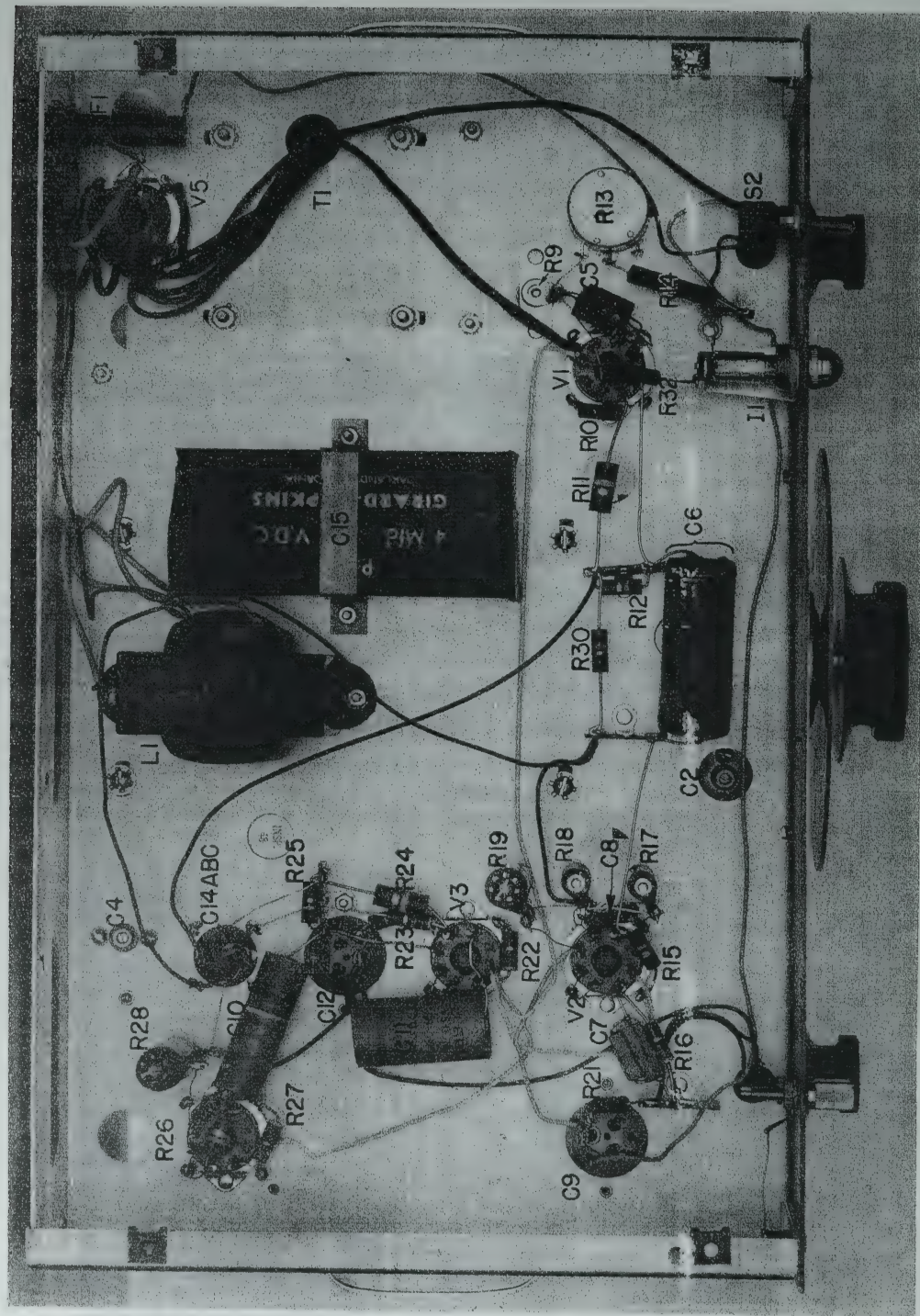
SCHEMATIC DIAGRAM OF MODEL 200D AUDIO OSCILLATOR  
SERIAL 70000 TO





Model 200D Top View  
Cover Removed





Model 200D Bottom View  
Bottom Plate Removed



TABLE OF REPLACEABLE PARTS

Circuit Ref.	Description	-hp- Stock No.	Mfr.# & Mfrs. Designation
C1 **	Capacitor: fixed, mica, 82 $\mu\text{f}$ , $\pm 5\%$	15-7	K CI-3
C2 **	Capacitor: variable, air, 100 $\mu\text{f}$	12-11	AA, A-103L
C3 **	Capacitor: variable, air, 4 sect. 525 $\mu\text{f}$ /section, C3 is com- posed of two 4 section capacitors	12-6	HP
C4 **	Capacitor: variable, air, 100 $\mu\text{f}$	12-11	AA, A-103L
C5	Capacitor: fixed, mica, 100 $\mu\text{f}$ Electrical value adjusted at factory	14-100	V Type OXM
C6	Capacitor: fixed, paper, .5 $\mu\text{f}$ , 600 vdcw	16-5	A Type 684
C7	Capacitor: fixed, mica, 2000 $\mu\text{f}$ Capacitor: fixed, mica, 500 $\mu\text{f}$ C7 = 2000 $\mu\text{f}$ and 500 $\mu\text{f}$ in parallel	14-13 14-500	V, Type W V, Type OXM
C8	This circuit reference not assigned		
C9	Capacitor: fixed, electrolytic, 40 $\mu\text{f}$ , 450 vdcw	18-40	X FPS-146
C10	Capacitor: fixed, paper, .1 $\mu\text{f}$ , 600 vdcw	16-1	A Type P688
C11	Capacitor: fixed, electrolytic, 10 $\mu\text{f}$ , 450 vdcw	18-10	X WB 72
C12	Capacitor: fixed, electrolytic, 40 $\mu\text{f}$ , 450 vdcw	18-40	X FPS-146
C13	This circuit reference not assigned		
C14 abcd	Capacitor: fixed, electrolytic, 20, 20, 20, 20 $\mu\text{f}$ , 450 vdcw	18-42	X FPQ-444
C15	Capacitor: fixed, paper, 4 $\mu\text{f}$ , 600 vdcw	17-3	P P8-4

\*See "List of Manufacturers Code Letters For Replaceable Parts Table."

\*\* These parts are also included in Capacitor Assembly, #D-7

TABLE OF REPLACEABLE PARTS

Circuit Ref.	Description	-hp- Stock No.	Mfr* & Mfrs. Designation
C16 **	Capacitor: fixed, mica, 51 $\mu$ mf, $\pm 5\%$	15-6	K CI-3
R1-R8	Part of Range Switch Assembly		
R9	Lamp: 6W, 120V, S6 clear bulb, Candelabra screw base	211-5	N
R10	Resistor: fixed, composition, 47,000 ohms, $\pm 10\%$ , 1W	24-47K	B GB 4731
R11	Resistor: fixed, composition, 100,000 ohms, $\pm 10\%$ , 2W	25-100K	B HB 1041
R12	Resistor: fixed, composition, 56,000 ohms, $\pm 10\%$ , 1W	24-56K	B GB 5631
R13	Resistor: variable, wirewound, 1000 ohms, linear taper	210-5	G 21-010-355
R14	Resistor: fixed, wirewound, 1500 ohms, $\pm 10\%$ , 1W	26-1500	R Type BW
R15	Resistor: fixed, composition, 560,000 ohms, $\pm 10\%$ , 1W	24-560K	B GB 5641
R16	Resistor: fixed, wirewound, 500 ohms, $\pm 10\%$ , 10W	26-5	S Type 1-3/4E
R17	Resistor: fixed, wirewound, 25,000 ohms, $\pm 10\%$ , 10W	26-11	S Type 1-3/4E
R18	Resistor: fixed, wirewound, 10,000 ohms, $\pm 10\%$ , 10W	26-10	S Type 1-3/4E
R19	Resistor: fixed, wirewound, 10,000 ohms, $\pm 10\%$ , 20W	27-4	S Type 2R
R20	Resistor: variable, composition, 25,000 ohms, linear taper	210-54	B JU 2531
R21	Resistor: fixed, composition, 10,000 ohms, $\pm 10\%$ , 1W	24-10K	B GB 1031
R22	Resistor: fixed, composition, 4700 ohms, $\pm 10\%$ , 1W	24-4700	B GB 4721

\*See "List of Manufacturers Code Letters For Replaceable Parts Table."

TABLE OF REPLACEABLE PARTS

Circuit Ref.	Description	-hp- Stock No.	Mfr* & Mfrs. Designation
R23	Resistor: fixed, composition, 47,000 ohms, $\pm 10\%$ , 1W	24-47K	B GB 4731
R24	Resistor: fixed, composition, 100,000 ohms, $\pm 10\%$ , 2W	25-100K	B HB 1041
R25	Resistor: fixed, composition, 56,000 ohms, $\pm 10\%$ , 1W	24-56K	B GB 5631
R26	Resistor: fixed, composition, 560,000 ohms, $\pm 10\%$ , 1W	24-560K	B GB 5641
R27	Resistor: fixed, wirewound, 500 ohms, $\pm 10\%$ , 10W	26-5	S Type 1-3/4E
R28	Resistor: fixed, wirewound, 5000 ohms, $\pm 10\%$ , 20W	27-3	S Type 2R
R29	Resistor: fixed, composition, 10,000 ohms, $\pm 10\%$ , 1W	24-10K	B GB 1031
R30	Resistor: fixed, composition, 10,000 ohms, $\pm 10\%$ , 1W	24-10K	B GB 1031
R31	Resistor: fixed, composition, 10,000 ohms, $\pm 10\%$ , 1W	24-10K	B GB 1031
R32, R33, R34	These circuit references not assigned		
R35	Resistor: fixed, composition, 33 ohms, $\pm 10\%$ , 1W	24-33	B GB 3301
	"Ampl." Dial:	35-1	HP
	"Range" Dial:	35-10	HP
	Dial Window:	M-2	HP
	Binding Post:	312-3	HP
C1, C2, C3, C4, C16	Capacitor Assembly:	D-7	HP
	Fixed Coupling:	M-25	HP

\*See "List of Manufacturers Code Letters For Replaceable Parts Table."

TABLE OF REPLACEABLE PARTS

Circuit Ref.	Description	-hp- Stock No.	Mfr* & Mfrs. Designation
F1	Fuse: 1 A, 3 AG type	211-1	T, #312001
	Fuseholder:	312-8	T, #342001
	Indicator Lamp Assembly:	312-10	BB, #807BS
	Knob: 1-1/2" diam.	37-11	HP
	Knob: 3" diam.	37-14	HP
I1	Lamp: 6-8V, .15A, miniature bayonet base	211-47	O, Mazda#47
	Lampholder: for R9	38-89	Leecraft Mfg. 659-1
P1	Power Cable:	812-56	HP
L1	Reactor: 6 H @ 125 MA, 240 ohms	911-12	HP
S1, R1-R8	Range Switch Assembly:	D-19W	HP
S2	Toggle Switch: SPST	310-11	D, #20994HW
T1	Power Transformer:	910-3	HP
V1	Tube: 6J7	212-6J7	ZZ
V2	Tube: 6F6	212-6F6	ZZ
V3	Tube: 6J7	212-6J7	ZZ
V4	Tube: 6V6	212-6V6	ZZ
V5	Tube: 5Y3GT	212-5Y3GT	ZZ

200D 10/13/50 Serial 70, 000 to

\*See "List of Manufacturers Code Letters For Replaceable Parts Table."



LIST OF MANUFACTURERS CODE LETTERS  
FOR REPLACEABLE PARTS TABLE

<u>Code Letter</u>	<u>Manufacturer</u>
A	Aerovox Corp.
B	Allen-Bradley Co.
C	Amperite Co.
D	Arrow, Hart and Hegeman
E	Bussman Manufacturing Co.
F	Carborundum Co.
G	Centralab
H	Cinch Manufacturing Co.
I	Clarostat Manufacturing Co.
J	Cornell Dubilier Electric Co.
K	Electrical Reactance Co.
L	Erie Resistor Corp.
M	Federal Telephone and Radio Corp.
N	General Electric Co.
O	General Electric Supply Corp.
P	Girard-Hopkins
HP	Hewlett-Packard
Q	Industrial Products Co.
R	International Resistance Co.
S	Lectrohm, Inc.
T	Littelfuse, Inc.
U	Maguire Industries, Inc.
V	Micamold Radio Corp.
W	Oak Mfg. Co.
X	P. R. Mallory Co., Inc.
Y	Radio Corp. of America
Z	Sangamo Electric Co.
AA	Sarkes Tarzian
BB	Signal Indicator Co.
CC	Sprague Electric Co.
DD	Stackpole Carbon Co.
EE	Sylvania Electric Products, Inc.
FF	Western Electric Co.
GG	Wilkor Products, Inc.
HH	Amphenol
II	Dial Light Co. of America
JJ	Leecraft Manufacturing Co.
ZZ	Any tube having RMA standard characteristics

## CLAIM FOR DAMAGE IN SHIPMENT

The instrument should be tested as soon as it is received. If it fails to operate properly, or is damaged in any way, a claim should be filed with the carrier. A full report of the damage should be obtained by the claim agent, and this report should be forwarded to us. We will then advise you of the disposition to be made of the equipment and arrange for repair or replacement. Include model number, type number and serial number when referring to this instrument for any reason.

## WARRANTY

Hewlett-Packard Company warrants each instrument manufactured by them to be free from defects in material and workmanship. Our liability under this warranty is limited to servicing or adjusting any instrument returned to the factory for that purpose and to replace any defective parts thereof (except tubes, fuses and batteries). This warranty is effective for one year after delivery to the original purchaser when the instrument is returned, transportation charges prepaid by the original purchaser, and which upon our examination is disclosed to our satisfaction to be defective. If the fault has been caused by misuse or abnormal conditions of operation, repairs will be billed at cost. In this case, an estimate will be submitted before the work is started.

If any fault develops, the following steps should be taken:

1. Notify us, giving full details of the difficulty, and include the model number, type number and serial number. On receipt of this information, we will give you service instructions or shipping data.
2. On receipt of shipping instructions, forward the instrument prepaid, and repairs will be made at the factory. If requested, an estimate of the charges will be made before the work begins provided the instrument is not covered by the warranty.

## SHIPPING

All shipments of Hewlett-Packard instruments should be made via Railway Express. The instruments should be packed in a wooden box and surrounded by two to three inches of excelsior or similar shock-absorbing material.

**DO NOT HESITATE TO CALL ON US**

**HEWLETT-PACKARD COMPANY**

*Laboratory Instruments for Speed and Accuracy*

395 PAGE MILL ROAD

PALO ALTO, CALIF.









